Testimony to the Committee on Energy and Commerce
Subcommittee on Energy and Air Quality
Thursday, May 18, 2006, 10:00 AM
2322 Rayburn House Office Building
Washington, D.C.

"Unlocking America's Energy Resources: Next Generation"

Troy D. Hammond, Ph.D.
Plextronics, Inc.

Thank you, Chairman Hall and members of the Subcommittee on Energy and Air Quality for the opportunity to present and discuss my views regarding new and innovative solar technologies. I have submitted a written copy of my testimony for the record and will summarize it for you today. First of all, I commend Chairman Hall for his leadership in having this hearing. This dialogue is important for America and I thank your Subcommittee for addressing the importance of innovation related to our current energy challenges.

My name is Troy Hammond and I am the Vice President of Products for Plextronics, Inc. in Pittsburgh, Pennsylvania. Plextronics was founded in 2002 as a spin-out of Carnegie Mellon University and was co-founded by Prof. Richard McCullough, Dean of the Mellon College of Science at Carnegie Mellon University, where he continues to play an active role in Plextronics. Our company is the leader of conductive polymer research, development, and commercialization. These conductive polymers are a type of plastic material that promise to shepherd in a new era of low-cost electronic devices including polymer photovoltaics, or solar cells.

On January 31, in his State of the Union address, The President announced the Advanced Energy Initiative stating that America's energy challenges, including our

continued economic and national security, can be addressed in part through revolutionary solar technology. The President set out a clear objective for the contribution of solar photovoltaic energy to the nations energy supply, namely to reduce the cost of solar photovoltaic technologies so that they become cost competitive by 2015.

The President has good reason to support solar technology. Solar photovoltaic devices directly convert sunlight to electric power in a clean, renewable manner with no direct emissions into the atmosphere.

However, today's solar technology cannot yet deliver cost competitive power. While residential, commercial and industrial customers pay less than $0.10 – 0.12 per kilowatt-hour in their electric bills, solar energy costs $0.25 to $0.50 per kilowatt-hour or more depending on the technology and the geographical location.

As an additional hurdle, the cost of solar technology comes as a large capital investment at the time of purchase. A residential consumer buying today's products would pay $10,000 or more for 2 kilowatts-peak of solar modules. Installation and necessary electronics increase the total cost to $15,000 to $20,000. Projected price decreases from the annual 30-40% market growth have flattened if not reversed. The President's objective will require a factor of three to five reduction in the installed system cost, which will translate into an energy cost of below $0.10 per kilowatt-hour by 2015.

Clearly, if America achieves these targets, it will be game-changing for the global energy industry. While some would propose that these goals can be achieved through evolutionary development of current technology, even advocating tens of billions of dollars of subsidies, we believe revolutionary thin film technologies can unlock the sun's

potential. Indeed, America's engine of research and invention has been making critical progress toward new solar technologies for many years.

For example, polymer photovoltaics utilize a novel version of plastics that strongly absorb the sun's light and behave like a semiconductor, analogous to silicon, in the generation of electricity. Rather than requiring expensive manufacturing equipment and processes, these polymers are turned into inks that can literally be printed much like a newspaper is printed. The total manufacturing cost can be as much as a factor of ten less costly for each square foot of solar module.

Key discoveries in this technology were made domestically. Current state-of-the-art polymer solar cells utilize a polymer technology invented by Prof. McCullough and manufactured by Plextronics, yet additional performance improvement is required. Plextronics' scientists have developed a portfolio of new polymer technologies that have the potential to double this performance and extend the lifetime of the technology. The focus of our technical development activity is the realization of this performance potential; when achieved, broad commercialization is possible.

Federal support at this juncture is critical. The President's 2007 Budget proposes a Solar America Initiative with a funding increase of $65 million over FY06. Given the impact that economic solar energy could have on global energy supply, we urge Congress not only to fund this program fully, but also to ensure America's leadership in revolutionary, new solar technologies is accelerated by the Solar America Initiative.

Troy D. Hammond, Ph.D.

Plextronics, Inc.

Summary

1. The President's Charge
    a. Make solar photovoltaic technology cost competitive by 2015
    b. Address this energy challenge through revolutionary solar technology
2. The Rationale
    a. Direct conversion of solar energy into electricity
    b. Clean, renewable, no emissions
3. The Issue
    a. Today's technology is not cost competitive
    b. $0.25-0.50 or more per kilowatt-hour versus $0.10 or less
    c. Large up-front capital costs (e.g. $20,000 for the residential consumer)
    d. Evolutionary improvements, even subsidized, won't suffice
4. The Opportunity
    a. Thin-film technologies promise revolutionary costs
    b. Polymer photovoltaics can be printed like inks at 5-10x lower cost
5. Plextronics, Inc.
    a. Key discoveries by Prof. McCullough; developed by Plextronics
    b. Potential to double current performance and enable commercialization
6. Federal support is critical, including the Solar America Initiative
    a. Fully fund this Initiative
    b. Demand strong focus on revolutionary technologies

TROY D. HAMMOND, Ph.D.
Plextronics, Inc.
2180 William Pitt Way
Pittsburgh, PA 15238
412-423-2030 x118
thammond@plextronics.com

PROFESSIONAL EXPERIENCE

PLEXTRONICS, INC., Pittsburgh, PA **2004-present**
Vice President, Products

Lead the company's product strategy, matching the capabilities of a platform technology with market opportunities. Provide the external face for the Company's technology to existing and potential investors, partners, and customers.

MILLIGAN COLLEGE, Johnson City, TN **2004-present**
Adjunct Professor

Teach the Operations Research/Statistics course in an MBA program designed for working professionals that combines weekend on-site lectures with online components.

MCKINSEY & CO., Pittsburgh, PA; Auckland, New Zealand **1996-2003**
Associate Principal

Worked closely with CEOs and their senior teams in a broad range of industries, domestically and internationally, on critical business issues in strategy, operations, sales and marketing, and risk management. Led large teams of managers and front-line employees to achieve performance impact. Leader in the energy sector including environmental compliance.

EDUCATION

MASSACHUSETTS INSTITUTE OF TECHNOLOGY, Cambridge, MA, PhD Atomic Physics **1996**

Thesis: Experiments demonstrated the first "atom interferometer," a device similar in concept to an optical instrument but relying on the wave nature of particles. Used the device to measure atomic properties, quantum-mechanical effects, and inertial forces (as the most sensitive gyroscope on earth). Required designing novel nanofabrication procedures to make free-standing silicon nitride gratings. Required design and build of mechanical, electronic, and laser/optical systems.

Honors: National Science Foundation Graduate Research Fellowship.

GEORGIA INSTITUTE OF TECHNOLOGY, Atlanta, GA, BS Physics, NSF-REU Fellowship**1990**

MILLIGAN COLLEGE, Johnson City, TN, BS Mathematics, *magna cum laude* **1989**